







Outpatient clinic for children with obstetric brachial palsy admitted to a rehabilitation hospital in Brazil: 10 years of experience in a multidisciplinary approach

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Introduction/Background: Obstetric brachial palsy (OBP) is characterized by flaccid paralysis secondary to injury to one or more roots of the brachial plexus during laborious labor. Specialized and systematized evaluation by a multidisciplinary team is important in the follow-up of these patients. The authors describe the ten first years of the specialized outpatient clinic in a health institution.

Methods: The medical records of all patients admitted with a brachial plexus injury that occurred during delivery at a health institution were evaluated. The children were evaluated using the Active Movement Scale (AMS) and the test score was applied at three months. Patients older than 2 years of age at the time of admission were excluded from the analysis.

Results: 454 children with PBO up to 2 years of age were admitted. Of the total, 54% of babies are female. The average age at admission was 4.7 months of age, with 56.4% being admitted at up to 3 months of age. Of the total admitted, 113 children underwent surgery to treat the brachial plexus.

Conclusions: Systematized evaluation associated with multidisciplinary monitoring allows a better evolution of the child who presented a brachial plexus injury at birth

Keywords: Neonatal Brachial Plexus Palsy, Brachial Plexus, Child, Rehabilitation

INTRODUCTION

Obstetric brachial palsy (OBP) is characterized by flaccid paralysis secondary to injury to one or more brachial plexus roots or trunks during laborious delivery [1]. The incidence of OBP in the United States is 0.9 cases per 1000 live births, with a reduction in the number of cases in the last 16 years [2,3]. There are no incidence data in Brazil [4].

The type of injury and its severity are variable, which leads to different prognoses and approaches [5]. Although most injuries are mild to moderate and present spontaneous recovery, about 34% will evolve with sequelae, including deformities, contractures, motor deficit and limb length discrepancy [6]. As a consequence, they may present limitations in activities of daily living, restrict participation in school and community, as well as psychosocial implications [7].

In all cases of OBP, initial treatment is conservative. The goals of therapy include maintaining joint range of motion, muscle strengthening, sensory stimulation, and functional use of the affected limb. However, there is little literature available about the functional rehabilitation of children with obstetric brachial palsy, and insufficient information regarding the time and duration of conservative treatment [7,8].

Each child must be evaluated individually and treatment (surgical or clinical) must be directed to their individual deficits. There are certain nuances in the natural history that, if ignored, will have a significant impact on both the function and appearance of the affected limb [9]. Likewise, surgical treatment requires a careful look with the use of an adequate instrument for pre and postoperative assessment to analyze the results. Multidisciplinary and longitudinal



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follow-up has been shown to be of great value in the treatment of these patients. Different centers have reported their experiences in the treatment of OBP, but with a focus on surgical treatment [10,11,12,13,14].

The objective of the present study was to describe the conservative/surgical treatment offered to children admitted under 2 years of age to the rehabilitation program during the first ten years of implementation of the OBP Outpatient Clinic.

MATERIALS AND METHODS

This is a retrospective cross-sectional study of the medical records of 454 children who were admitted under 2 years of age from January 2011 to June 2021 at a referral hospital for rehabilitation in Brasília, Brazil. The choice of this age criterion (≤ 2 years) aimed to include all patients with the possibility of indicating brachial plexus microsurgery, considering that there is a percentage of patients with late presentation to our service, when neurosurgical treatment would no longer be feasible.

Data were collected on medical records, physical-functional assessment, modalities of care in the program, participation in the OBP outpatient clinic and surgical indication.

The following variables were collected and analyzed: age at admission in months, child's sex, assessment on the active movement scale (AMS), need for surgery, type of surgery performed, result of surgery and complications. The data were organized in an Excel spreadsheet and the simple average and percentage were used for better presentation of the results. The data was analyzed in the spreadsheet where percentages and averages were calculated.

The study was submitted to and approved by the research ethics committee.

RESULTS

From January 2011 to June 2021, 454 children with OBP up to 2 years of age were admitted. Of the total, 54% of babies are female. The mean age at admission was 4.7 months of age, and 56.4% were admitted up to 3 months of age.

Regarding neurological function, patients were evaluated using the AMS scale. Surgery was indicated in 24% of patients. Approximately 76% were not operated on due to having good results in the clinical evaluation ($AMS > 5$). Non-operated patients continued clinical treatment.

Clinical treatment

The patients were admitted in a team (doctor and therapist), and 95% were immediately referred to the child rehabilitation program. In the program, 81% were seen again by physiotherapy (FT) and/or occupational therapy (OT) aiming at physical and functional reassessment, definition of use of orthoses, evaluation of postoperative results and/or team discussion. In addition to individual consultations with FT/OT, 65% of the babies admitted were included in a specific biweekly program aimed at conservative treatment, which included mobility and function of the affected limb, stimulation of development and family guidance. The percentage that did not participate in the biweekly program resided in other states and were followed up in quarterly or half-yearly reviews. Upon admission, all families were trained to perform passive exercises and received access to an exercise program with videos, through the Physitrack® application (www.physitrack.com.br), with daily guidance at home.

Other assistance with the team included training in activities of daily living; sensory stimulation/body perception; use of virtual reality and participation in swimming and sports groups, aiming at the functional use of the affected limb, muscle strengthening and participation in activities suitable for the age group. The service modalities were chosen based on the stage of development and the objectives outlined.

In the years 2020 and 2021, due to the COVID 19 pandemic, the remote service modality was implemented with evaluations and guidance by video calls, in addition to monitoring through an exercise application, allowing the continuity of treatment, even at a distance.

Participation in the OBP outpatient clinic was defined during follow-up. The objectives included attention to the family's demands regarding recovery, surgical indication, postoperative results and/or definition of new rehabilitation goals. A total of 314 children under 2 years of age were treated at the OBP outpatient clinic (Table 1).

Surgical treatment

After physical-functional assessment, imaging documentation and team discussion, 164 children underwent at least one surgery during the study period. A total of 113 babies underwent microsurgery in the first two years of life. Among them, 35 were later submitted to orthopedic procedures and 51 children in the sample were submitted only to orthopedic surgeries (Figure 1), with no previous need for microsurgery.

The main indication for surgery was based on the elbow flexion function in patients. Those children who, up to six months of age, did not perform elbow flexion greater than 50% of joint movement were recommended surgery. In

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Table 1 - Number of admissions of children with OBP < 2 years and participation in the OBP outpatient clinic during the study period.

Year	New cases	OBP clinic	%
2011	38	24	63%
2012	45	25	56%
2013	38	26	68%
2014	30	23	77%
2015	41	32	78%
2016	45	34	76%
2017	56	46	82%
2018	44	34	77%
2019	45	30	67%
2020	39	28	72%
2021*	33	13	39%
Total	454	315	69%

* data collected until June/2021.

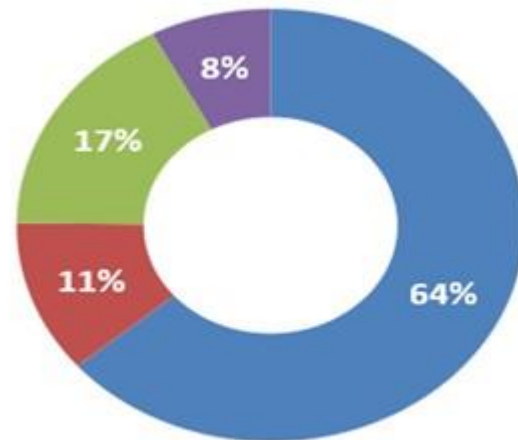


Figure 1- Blue – No surgical procedures, green -nerve surgery only , red – Only orthopedic surgery, purple - nerve surgery and orthopedic surgery. Distribution of surgical procedures performed from Jan/2011 to June/2021.

patients with severe injuries, the indication was loss of hand function. In children with Erb type paralysis, superior plexus, the surgery indicated was nerve transfer. In severe injuries, patients underwent grafts.

The early surgeries most commonly performed by the neurosurgery team were: exploration of the brachial plexus, transfer of the ulnar and/or median nerve to the musculocutaneous nerve, transfer of intercostal nerves to the musculocutaneous nerve, and transfer of the accessory nerve to the suprascapular (Figure 2). The mean age was 10 months at the time of surgery. In 86% of cases we obtained improvement in elbow flexion function for at least AMS 5. Shoulder abduction improved in 64% of patients and external rotation in 37%. The mean surgical time was 90 minutes. No major complications occurred. Minor complications occurred in 4 cases and were small skin dehiscences.

The orthopedic surgeries performed were aimed at improving limb positioning or active external rotation of the shoulder, prevention or correction of shoulder dislocation, among others (Figure 1). The most common procedures performed by orthopedics were: myoneural block, latissimus dorsi and lower trapezius transfers to infrascapula/infraspinatus, associated or not with stretching of the shoulder internal rotators (Figure 3).

DISCUSSION

Faced with the need to advance in the treatment offered to patients with PBO in our Institution (Hospital SARA, Brasília/DF), in 2011 the OBP multidisciplinary outpatient clinic was created, comprising neurosurgery, orthopedics, physiotherapy, occupational therapy and nursing. Long-term care by a multidisciplinary team allowed the discussion of cases, expanded the view of the natural history of OBP, facilitated the decision-making process and the monitoring of surgical results. The team specialized, participating in symposia and congresses with leading professionals in the area. The clinical assessment was modified. In addition to passive goniometry, assessment of limb functionality, performance in activities of daily living, and photo recording of limb posture and functional movement video, new assessment scales were introduced, specific to obstetric brachial palsy, such as the Mallet and the Active Movement Scale (AMS) [15,16]. In children admitted early, The Hospital for Sick Children's criteria for microsurgery were adopted, applying the Test Score at 3 months and the Cookie Test at 9 months.¹⁷ For patients at risk of shoulder subluxation, muscle imbalances and/or orthopedic deformities, there was an increase in orthopedic surgical possibilities, including muscle and capsular stretching, tendon transfers, osteotomies.

We observed during the study that babies have been admitted in the first months of life, as a team. The literature points out that early referral to a multidisciplinary center is

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importante [18]. In the aforementioned period, there was improvement in functional assessment, earlier initiation of rehabilitation, inclusion of new modalities of conservative treatment and long-term follow-up, which made it possible to define surgical procedures at the appropriate time, greater adherence of families and greater commitment of patients to the treatment.

Despite the scarce literature that evaluates results focused on activity and participation, we believe that the early start of conservative treatment with motivating activities and focused on the family context, can bring better results. Recent evidence suggests that many children with neurological impairment can improve performance if given sufficient training opportunities.⁸ Training can take place inside and outside the rehabilitation clinic, increasing opportunities.

Systematic reviews, such as those by Palomo and Sanchez, provide evidence of results measured by scales already systematized, and used by our team, which focus on structure and function (eg: Mallet and AMS) [18,19]. The current challenge involves establishing the use of assessments focused on activity and participation, which can measure our results and help us to constantly improve our rehabilitation program.

Data analysis suggests that 25% of patients have greater impairment, requiring early neurosurgical intervention. The remainder presents a favorable evolution to conservative treatment, and may later be submitted to orthopedic surgeries due to deformities or muscle imbalances.

Surgical indications were evaluated in two ways: complete lesions and upper plexus lesions (Erb Type). There is great variation in the literature regarding the right time to recommend surgery. We chose to use the approach described by Clarke, due to a significant proportion of patients being admitted to the outpatient clinic late [16]. Although the literature reports that 70-80% of cases progress satisfactorily with conservative treatment, 36% of our sample has already undergone surgery [20,21].

We observed so far that 64% of the sample evolved well with conservative treatment, but some children will undergo orthopedic surgery over the years, decreasing this percentage. This reinforces the importance of longitudinal follow-up, specialized and standardized assessments and a multidisciplinary approach, always seeking a better quality of life for the patient.

In summary, we can say that of the 454 babies admitted up to 2 years of age, 36% underwent neurosurgery and/or orthopedic surgeries in a period of 10 years. Around 64% of the sample had not been submitted to surgical procedures so far. It is important to emphasize that the percentage of

orthopedic surgeries in this sample does not represent well the number of orthopedic surgeries performed in patients with OBP in our service. Many patients in the sample are still small children and will have an indication for orthopedic surgery as they grow. Other patients from our service were admitted after two years, so they are not part of this sample, but underwent orthopedic surgery.

After the surgical procedures and recommended immobilization time, the children are evaluated and followed up in the Sarah Hospital's children's rehabilitation program.

Over the years, new therapeutic modalities have been included in the postoperative follow-up, such as virtual reality resources, in addition to physical activities such as swimming, canoeing and table tennis, which, because they are more playful, enabled greater patient engagement, in addition to allowing the training of specific movements.

CONCLUSION

During this period, we have confirmed the importance of early admission, longitudinal follow-up and care in a multidisciplinary team. Despite being a diagnosis with a favorable evolution in most cases, there is a significant portion of patients that encourages us to invest in improvement in conservative treatment, surgical technique, postoperative rehabilitation and assessment instruments.

We believe that further studies will emerge from this sample that has been closely monitored since the first months of life.

DISCLOSURES

Ethical approval

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the local Ethics Committee, number: 5.402.371 CEP Associação das Pioneiras Sociais DF

Consent to participate

The patient gave consent to use his information and images for publication.

Conflict of interest

The authors declare no conflicts of interest with respect to the content, authorship, and/or publication of this article.

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Artificial intelligence

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CONTRIBUTIONS

-Ricardo de Amoreira Gepp: Conceptualization, Formal Analysis, Investigation, Methodology, Project administration, Supervision, Writing – original draft, Writing – review & editing

-Giuliana Giuliana Grechi: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Resources, Writing – original draft, Writing – review & editing

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Conceptualization, Data curation, Investigation, Writing – original draft

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